
Libby Asbestos Superfund Site
Operable Unit 3
Phase III Remedial Investigation
Field Sampling Summary Report
Activity-Based Sampling

January 2010

FIELD SAMPLING SUMMARY REPORT

**PHASE III REMEDIAL INVESTIGATION
OPERABLE UNIT 3**

ACTIVITY-BASED SAMPLING

LIBBY ASBESTOS SUPERFUND SITE

January 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

µm	micrometer
AOC	Administrative Order on Consent
CDM	Camp Dresser McKee, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminant(s) of concern; chain-of-custody
EPA	U.S. Environmental Protection Agency
FD	field duplicate
FSDS	field sample data sheet
FSSR	Field Sampling Summary Report
GIS	geographic information system
GPS	global positioning system
HEPA	high-efficiency particulate-air
Index ID	index identification number
KDC	Kootenai Development Corporation
LA	Libby Amphibole
LPM	Liter per minute
MCE	microcellulose ester
MDEQ	Montana Department of Environmental Quality
mL	milliliter
MWH	MWH Americas, Inc.
OU	Operable Unit
PLM-VE	polarized light microscopy and visual estimation
PPE	personal protective equipment
QC	quality control
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SRC	Syracuse Research Corporation
TEM	transmission electron microscopy

1.0 PROJECT OVERVIEW

1.1 BACKGROUND SUMMARY

The vermiculite deposit at Vermiculite Mountain, six miles northeast of Libby, Montana, contains veins of asbestiform amphibole minerals (e.g., winchite, richterite and tremolite). The asbestiform amphibole minerals that occur at Vermiculite Mountain are collectively termed "Libby Amphibole" (LA) by the U.S. Environmental Protection Agency (EPA). Historic mining, milling, and processing of vermiculite from the former W.R. Grace mine at Vermiculite Mountain released LA fibers to the environment. Long-term inhalation of large quantities of LA fibers associated with the vermiculite is known to have caused adverse health effects in some workers at the mine and processing facilities and possibly in others in Libby.

In 2000, EPA began cleanup actions at Libby under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; also known as Superfund) to eliminate sources of LA exposure to residents and workers. Initial efforts were focused mainly on wastes remaining at former vermiculite processing areas. As work progressed, action shifted to cleanup of homes and workplaces in the residential/commercial areas of Libby, designated by EPA as Operable Unit 4 (OU4) of the Libby Asbestos Site.

As part of the Superfund designation of the Libby Asbestos Site, the former mine and environs at Vermiculite Mountain were designated OU3. OU3 includes the property in and around the former vermiculite mine and forest areas surrounding the mine that may have been impacted by releases and subsequent migration of contaminants from the mine. Figure 1-1 shows the location of the mine site and the preliminary study area boundary of OU3. EPA established the preliminary study area boundary for the purpose of planning and developing the scope of the remedial investigation/feasibility study (RI/FS) for OU3. This study area boundary may be revised as data are obtained on the nature and extent of environmental contamination associated with releases that may have occurred from the mine site.

1.1.1 Phase I Remedial Investigation

In September 2007, EPA initiated a Remedial Investigation/Feasibility Study (RI/FS) of OU3 and produced the *Phase I Sampling and Analysis Plan for Operable Unit 3, Libby Asbestos Superfund Site* (OU3 Phase I SAP) to begin the characterization of environmental conditions at OU3. The OU3 Phase I SAP contains information on the history and operations of the former mine and discussions on general site geography, geology, hydrology and other relevant background information. The SAP also contains the preliminary sampling locations and the Standard Operating Procedures (SOPs) that were used as guidance during the OU3 Phase I RI performed in October 2007. Phase I included sampling and analysis of soil, mine wastes, sediment, surface water, and ambient air at the former mine site, and tree bark, duff and mineral soil on the mine site and in surrounding forested areas within an eight-mile radius of the mine site. The field sampling performed as part of the Phase I RI is summarized in the *Phase I Field Sampling Summary Report* (Phase I FSSR), which documents the sampling locations and procedures employed during the Phase I RI at OU3.

Prior to implementing the OU3 Phase I RI, EPA had collected very limited information to evaluate contaminants of potential concern at the former Vermiculite Mountain mine property and potential releases to adjacent forest lands, surface water and groundwater. Areas outside the former mine property are of potential concern because they are used by the public for recreation, by logging companies for timber harvesting, and by wildlife as habitat. Contaminants of potential concern at OU3 include not only LA, but other mining-related contaminants that may have been released to the environment. The overall objective of sampling at OU3 is to collect sufficient information to allow evaluation of risks to humans and ecological receptors from exposure to mining-related releases, and to support the development and evaluation of remedial alternatives to address any unacceptable risks that are identified. This will occur over multiple, phased sampling events; the findings of each phase of sampling will be used to guide subsequent phases of investigation.

Phase I sampling and analysis was intended to provide initial information on the nature and extent of asbestiform LA and non-asbestos contamination, to identify contaminants of potential concern to be investigated during the RI, and to begin collection of data to establish a study area boundary for subsequent phases of the RI. Phase I was not expected to provide data that would be sufficient to fully characterize the nature and extent of contamination or to support a risk assessment. Rather, the results of Phase I were intended to provide sufficient information so that a more detailed and extensive sampling effort (Phase II) could be designed for implementation during the 2008 field season.

1.1.2 Phase II Remedial Investigation

The Phase II RI was performed from early April through October, 2008 and consisted of three parts: Part A (surface water and sediment sampling), Part B (groundwater and ambient air sampling) and Part C (ecological sampling). Part A field sampling was performed in accordance with the *Phase II Sampling and Analysis Plan for Operable Unit 3, Libby Asbestos Superfund Site; Part A: Surface Water and Sediment*, final version dated May 29, 2008 (Phase IIA SAP). Part B field sampling was performed in accordance with the *Phase II Sampling and Analysis Plan for Operable Unit 3, Libby Asbestos Superfund Site; Part B: Ambient Air and Groundwater*, final version dated July 2, 2008 (Phase IIB SAP). Part C was performed in accordance with the *Phase II Sampling and Analysis Plan for Operable Unit 3, Libby Asbestos Superfund Site; Part C: Ecological Data*, final version dated September 17, 2008 (Phase IIC SAP).

Parts A and B of the Phase II RI focused on mine-site media (surface water, groundwater, sediments and ambient air) to more fully characterize the nature, extent and seasonal variation of contamination on the former mine property. Field activities performed under Parts A and B of the Phase II SAP are summarized in the *Phase II Field Sampling Summary Report, Parts A and B*. Part C of the Phase II RI included ecological sampling performed by Parametrix, Inc. in late September and early October, 2008, and is summarized in separate documents.

1.1.3 Phase III Remedial Investigation

The Phase III RI at OU3 began in early June, 2009. Activity-based sampling (ABS) was conducted in accordance with the *Remedial Investigation for Operable Unit 3, Libby Asbestos Superfund Site Phase III Sampling and Analysis Plan* (Phase III SAP), as amended by field modifications issued by EPA. Ecological sampling performed by Parametrix, Inc. at OU3 during the 2009 field season is discussed in a separate document.

1.2 PURPOSE OF THE PHASE III REMEDIAL INVESTIGATION

The results of Phase I sampling and analysis of forest materials (tree bark, duff and mineral soil) from the lands that surround the mine site were used to select locations where ABS was performed during Phase III. Phase III ABS was intended to simulate the activities of recreational visitors to the forest lands that surround the mine site and the concentrations of LA to which such visitors may be exposed. Data generated during Phase III ABS will be used in human health risk assessments and possibly as a basis for management decisions by the U.S. Forest Service and other forest-land stakeholders.

1.3 PURPOSE OF THIS DOCUMENT

This Phase III FSSR is a summary of ABS performed in support of the RI/FS at OU3 during the 2009 field season. OU3 includes the property at and around the former vermiculite mine at Vermiculite Mountain potentially impacted by releases and subsequent migration of hazardous substances from the mine site and former mine operations (the preliminary boundaries of OU3 are depicted on Figure 1-1 of this document). The final boundaries of OU3 had not been defined prior to Phase III RI field sampling in June 2009. Final boundaries for OU3 will be based primarily upon the extent of contamination associated with releases from the former mine, as determined by analytical results for samples collected during Phases I, II, III and any subsequent phases of the RI. The final boundary of OU3 will be defined in the final EPA-approved RI/FS report.

This FSSR is a summary of sampling activities, locations and methods employed during the Phase III RI at OU3. Analytical results for samples collected during the Phase III RI are not presented in this document; analytical data and interpretations are summarized as part of Sampling and Analysis Plans (SAPs), which heretofore have been prepared by EPA for implementation during each field season or phase of work. Phase III analytical results will be the basis for the data-gathering activities and scope of subsequent phases of RI at OU3. After all RI activities have been completed, a comprehensive RI Report will be prepared. The RI Report will contain all analytical results, interpretations and conclusions for the OU3 Remedial Investigation.

1.4 PROJECT ORGANIZATION

1.4.1 Project Management

EPA is the lead regulatory agency for Superfund activities within OU3. The EPA Remedial Project Manager (RPM) for OU3 is Bonita Lavelle of EPA Region 8. Ms. Lavelle is a principal data user and decision-maker for Superfund activities within OU3.

The Montana Department of Environmental Quality (MDEQ) is the support regulatory agency for Superfund activities within OU3. The MDEQ Project Manager for OU3 is Catherine LeCours. EPA consults with MDEQ as provided for by CERCLA, the National Contingency Plan, and applicable guidance in conducting Superfund activities at OU3.

EPA has entered into an Administrative Order on Consent (AOC) with Respondents W.R. Grace & Co.-Conn. and Kootenai Development Corporation (KDC). Under the terms of the AOC, the Respondents implemented the Phase I, Phase II and Phase III SAPs at OU3. The designated Project Coordinator for the Respondents is Robert Medler of Remedium Group, Inc., a subsidiary of W.R. Grace & Co.-Conn.

1.4.2 Technical Support

EPA was supported in this project by contractors, including:

- Syracuse Research Corporation (SRC) assisted in the development of the Phase III SAP and will assist in the evaluation and interpretation of the Phase III analytical data.
- NewFields Boulder LLC, as a subcontractor to SRC, provided support in developing the SAP and with mapping and other geographic information system (GIS) applications, and will assist in the design and evaluation of the feasibility study.

1.4.3 Field Sampling Activities

Phase III ABS field sampling activities were performed by W.R. Grace & Co.-Conn. and KDC with support from MWH Americas, Inc. (MWH) and Chapman Construction, Inc. (CCI) of Libby, Montana, in accordance with the Phase III SAP and field modifications authorized by EPA (see Appendix A of this FSSR). Individuals responsible for implementation of the OU3 Phase III field sampling program are listed below:

- MWH Project Manager/Field Supervisor: John Garr
- MWH Field quality control (QC)/Health and Safety Officer: Toby Leeson
- MWH Quality Assurance Officer: Stephanie Boehnke
- CCI point-of-contact: Mike Chapman

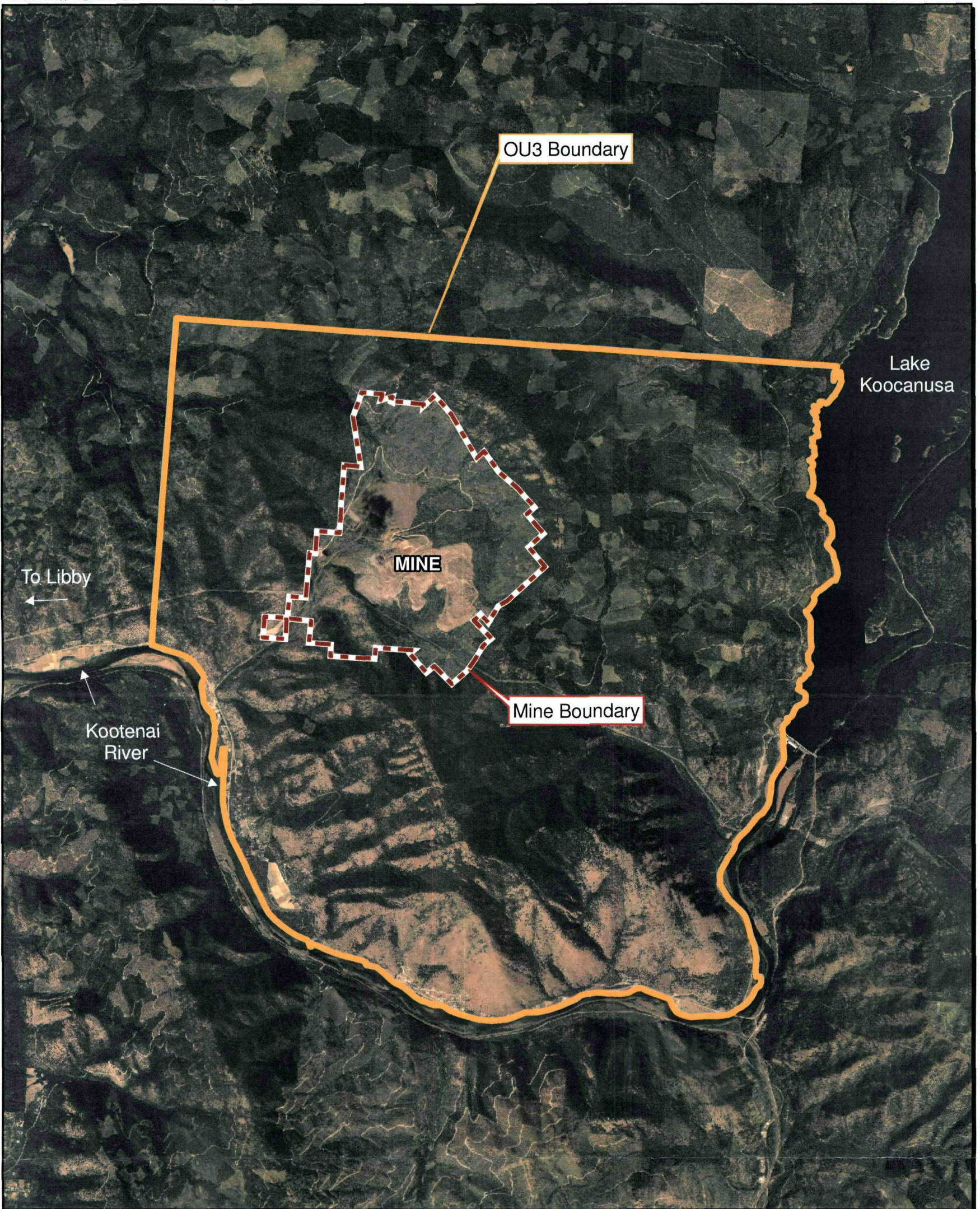
1.4.4 Sample Preparation and Analysis


All samples collected as part of the OU3 Phase III RI were submitted to an EPA-selected/approved laboratory for preparation and/or analysis. All sample analyses for LA were performed Hygeia Analytical Laboratories of Sierra Madre, California, and all analytical data validation and verification is to be performed by SRC.

1.4.5 Data Management

Administration of the OU3 master database is performed by EPA contractors. The primary database administrator is Lynn Woodbury of SRC. Ms. Woodbury is responsible

for sample tracking, uploading new data, performing error checks to identify inconsistent or missing data, and ensuring that all questionable data are checked and corrected as needed. When the OU3 database has been populated, checked and validated, relevant LA data from the Phase III RI will be transferred into the Libby2 database for final storage.



	PROJECT: W. R GRACE LIBBY, MONTANA	 10619 South Jordan Gateway Suite 100 Salt Lake City, Utah 84095	Date: 01/21/10 Rev:
	FIGURE TITLE: LOCATION OF MINE SITE AND PRELIMINARY OU3 STUDY BOUNDARIES		FIGURE NO: 1-1

2.0 PHASE III ACTIVITY-BASED SAMPLING

2.1 SUMMARY OF PHASE III ACTIVITY-BASED SAMPLING PROGRAM

The objective of OU3 Phase III activity-based sampling (ABS) and analysis was to provide information to characterize LA concentrations to which visitors to the forest lands that surround the mine site may be exposed while engaging in typical recreational activities, including:

- All-terrain vehicle (ATV) riding
- Hiking
- Wood-gathering
- Fire-pit digging
- Campfire burning

These activities were performed according to an ABS script detailed in the Phase III SAP and amended by field modifications issued by EPA. The following sections of this FSSR are summaries of the ABS performed during Phase III.

2.2 ABS LOCATIONS

Data collected from 2006 through 2009 at the Vermiculite Mountain mine site meteorological station indicate the predominant wind direction in the OU3 area is to the northeast. The 11 locations selected by EPA for the Phase III ABS program in 2009 generally coincide with three "downwind" transects along which tree bark, duff and mineral soil were sampled during the Phase I RI in October, 2007. The downwind transects are centered on the mine site and radiate 8 miles out, at bearings of N15°E, N45°E and N75°E (Figure 2-1).

Before final selection of Phase III ABS locations, the initially proposed locations were field checked by MWH. Based on this reconnaissance, minor adjustments (up to about 0.5-mile) were made to some of the proposed locations to ensure that access, forest and logging roads (for ATV riding), topography, forest density and other site features were such that ABS could be conducted safely and effectively.

2.3 ABS CONDITIONS

ABS was conducted only on days when there was no rain, no standing water on the forest and logging roads, and when visible dust was generated by driving trucks and ATVs on the unpaved roads at normal speeds (20 mph or less).

2.4 PERFORMANCE OF ABS SCRIPT

The activities chosen for ABS during the Phase III RI were intended to represent those performed by hunters, hikers, campers and others who use the forest land for recreation. The details and durations of the original script components contained in the final SAP dated May 26, 2009 were adjusted during pilot testing in mid-August, 2009, after it was learned that almost all of the samples collected under the original ABS script in July 2009 were heavily loaded with dust and could not be analyzed by direct methods. EPA-issued field modifications to the original ABS script contained in the final SAP dated May 26, 2009 are provided in Appendix A (on CD in pocket).

The ABS script was performed by two teams, each consisting of two CCI employees (who performed the activities) and one MWH employee (who directed the activities by two-way radio, recorded field data and managed the samples). During the 2009 field season, after the final (third) revision of the Phase III SAP (dated August 31, 2009) had been issued, six full rounds of ABS were performed at each of the 11 designated locations. The seventh and eighth rounds were incomplete (with eight locations and three locations sampled, respectively) because sampling was interrupted by rain and snow storms.

2.4.1 ABS Participants

Each ABS activity was performed by the two CCI employees ("participants"), who were designated "Person 1" and "Person 2." Each ABS participant was fitted with two air-sampling pumps and sampling cassettes: one pump was set to draw air through the filter cassette at 4 liters per minute (LPM), the other was set to pump at 2 LPM. The laboratory was instructed to analyze the 4 LPM sample collected by Person 1 if the inner

surface of the cassette cowling was free of dust and the filter was not overloaded. If the 4 LPM cassette worn by Person 1 was determined by the laboratory to be overloaded, the 2 LPM cassette worn by Person 1 was selected for analysis. If the Person 1, 2 LPM cassette was overloaded, that sample would be analyzed by indirect methods. Samples collected by Person 2 were retained by the laboratory as replicate samples. Thus, three sets of four sample cassettes were used at each location during each round of ABS. One set was used during ATV riding, one set was used during hiking, and one set was used for the composite wood gathering/fire-pit digging/campfire burning activities.

The ATV riding and hiking activities were done by having Person 1 initially lead and Person 2 follow; the participants switched lead/follow positions half-way through the activity duration. The wood-gathering, fire-pit digging and campfire burning activities were performed simultaneously by the two participants, each wearing a set of two pumps and air-sampling cassettes. In other words, the ATV riding and hiking samples were collected as discrete samples; the samples collected during the wood-gathering/fire-pit digging/campfire burning activities were composites. Because the participants' exposure times and activities were identical, samples collected by Person 1 and Person 2 are considered to be replicates.

Each ABS participant was fitted with a wrist-worn global positioning system (GPS) device to record their movements during the ABS activities. Figures 2-2 through 2-9 depict the tracks of ABS during each of the six complete and two partial rounds of ABS conducted during Phase III.

Because they were actively disturbing potentially contaminated soil, duff and vegetation during performance of the ABS script, the two ABS participants wore Level C Modified personal protective equipment (PPE) consisting of the following:

- Full-face powered air-purifying respirator (PAPR) fitted with high-efficiency particulate-air (HEPA) filters
- Double-layer Tyvek™ hooded, footed coveralls

- Latex boot covers
- Double-layer nitrile gloves

2.4.2 ABS Director

Performance of the ABS script was overseen by an MWH employee (“director”) who stayed at a “base station” established on a road within the ABS location. The ABS director used a stopwatch to time each activity and a two-way radio to communicate lead/follow position switches and activity changes to the participants. The ABS director was also responsible for calibrating and adjusting the air sampling pumps, recording data on the field sampling data sheet (FSDS) and in the logbook, maintaining the sample chain-of-custody (COC) and managing the sample cassettes. Because the ABS director remained at the base station during performance of the ABS script and did not actively disturb potentially contaminated materials, they were not required to wear a respirator or other PPE.

2.5 ABS SCRIPT COMPONENTS

2.5.1 ATV Riding

With the exception of the ABS-10 location, ATV riding was performed on unpaved forest and logging roads within each ABS location boundary (or in instances where roads were limited, within a half-mile outside the boundary). Because there are no roads within the boundary of the ABS-10 location (see Figure 2-1), ATV riding at this location was performed on the nearest forest road west of ABS-10, in upper Rainy Creek.

The ATVs were operated at speeds of 10 miles per hour or less. For the first 10 minutes of the activity, Person 1 led and Person 2 followed; the participants switched the lead/follow positions for the second 10 minutes of the activity. The participants were instructed to follow the lead ATV at the distance they would follow under normal recreational conditions, if they were not wearing PPE. The following distance was dependent on the amount of dust generated by the lead ATV, which varied as a function of road material type and moisture content, humidity, air temperature, wind speed and

direction and other factors. During rounds performed under less-dusty conditions, the following distance was typically less than 50 yards; under very dry, dusty conditions the following distance was as much as 200 yards.

2.5.2 Hiking

At the conclusion of the ATV riding activity, the participants were given fresh cassettes for use during the hiking activity. Hiking was performed within each ABS location boundary, generally in less-densely-forested, more open areas likely to be used by recreational visitors. As in ATV riding, Person 1 would lead for the first half (40 minutes) of the activity and Person 2 would follow, switching positions for the second 40 minutes of the hiking activity. The following distance was typically about ten feet. To the extent possible, different areas were hiked during each ABS round.

2.5.3 Wood Gathering

At the conclusion of the hiking activity, the participants were given fresh sample cassettes and spent 10 minutes collecting about 40 pounds of dead-and-down pine and fir wood for use during the campfire burning activity. At most locations a mix of hand-broken and chainsawed pieces up to 2 feet long were collected and placed in a 55-gallon, 10-mil polyethylene bag. The pieces ranged from 2 to 8 inches in diameter. To the extent possible, pieces with bark were selected. The bag of wood was closed, taped and labeled with the location identification, date and time, and placed in the bed of the truck for transport to the Flyway for burning under controlled conditions.

2.5.4 Fire-Pit Digging

At the conclusion of the wood-gathering activity, the participants each used a shovel to clear vegetation, duff and other combustible debris down to the mineral soil layer from an area of forest floor about 5 feet in diameter. This activity simulated the preparation of a fire pit, as might be performed by a camper, and lasted 5 minutes. Locations selected for fire-pit digging were typically near the base station, but a different location was selected for each ABS round. At the conclusion of fire-pit digging, the pumps were turned off and

the sample cassettes were capped and stored until later use during the campfire burning activity.

2.5.5 Campfire Burning

The building of campfires with wood collected from each ABS location was done at the Remedium decontamination area on the north bank of the Kootenai River immediately upstream from the mouth of Rainy Creek (an area known as the "Flyway"). Each fire was built in a 3-foot square, 6-inch high welded steel pan placed on a 3-inch thick pad of sand and gravel about 16 feet in diameter. As a further precaution against uncontrolled fires, the area outside the gravel pad was sprayed with water under gravity flow through a garden hose attached to a 500-gallon water tank.

Prior to building the campfire, participants donned new PPE, the air sampling pumps and cassettes used during the wood gathering and fire-pit digging activities were re-attached, and the pumps were started. To start the fires quickly, logs collected from each ABS location were piled in the pan and gasoline was used to ignite the wood.

Once the fire was started, the participants walked slowly around the edge of the gravel pad for 20 minutes. At the conclusion of the burning period, the air sampling pumps were turned off, the sample cassettes were collected and capped, the fire was extinguished with water and the steel pan was decontaminated by rinsing the charred wood and ashes into a trash can for later disposal at the Amphitheater on the mine site.

2.6 ABS EQUIPMENT AND INSTRUMENTATION

- Air Sampling Pump: SKC model AirChek XR5000™ (0.005 – 5.0 LPM)
- Sample Cassette: 25mm 0.8-micron pore size, conductive, cowled MCE cassettes
- Inert tubing: Tygon™ R-3603 tubing, 1/4" inner diameter and 7/16" outer diameter
- Primary Calibrator: BIOS Intl. DryCal DC-Lite™ model MH (0.2 – 17 LPM)

- Secondary Calibrator: Dwyer rotameter, SKC model 320-4A5 (0.4 – 5 LPM)
- GPS Unit: Garmin Forerunner™ model 205 wrist-worn GPS
- ATVs: Polaris Ranger™ 4x4 2-passenger all-terrain vehicles, Honda FourTrax Rancher™ 400cc and Suzuki QuadSport Z400™ 400cc 4x4 single-passenger all-terrain vehicles
- Sample Storage: Vendor-supplied, partitioned cassette shipping boxes.
- Sample shipping: Small insulated plastic coolers with integrated handles on top to ensure the container remained upright during shipment to the laboratory.
- Field logbook: Rite in the Rain™ all-weather journal 390N
- Pens: Rite in the Rain™ all-weather pen #37, various ball point pens, and permanent markers
- Photo identification board: 12"x20" dry-erase board
- Camera: Nikon Coolpix L17™ digital camera
- 2-way radios: Motorola Talkabout T9500XLR™ FRS (UHF-band)

2.7 SAMPLING METHODS

2.7.1 Sample Collection

The participants each wore two AirChek XR5000™ air-sampling pumps attached to belts worn outside their PPE (one set to pump at 4 LPM, the other set at 2 LPM). Tubing from each pump was duct-taped to the back of the participant's Tyvek™ coveralls, with the open ends of the tubing positioned on either side of the participant's neck. With the tubing in-place, the ABS director removed the plug from the discharge side of each cassette and attached the cassette to the tubing. Each sample cassette was taped in-place, with the open (intake) end of the cassette cowl aimed downward, within the participant's breathing zone (about 9 inches from the participant's face).

Sampling cassette cowl caps remained in-place until the activity began and the pumps were turned on. During the activity, the ABS director retained the caps and stored them in a closed Ziploc™ plastic bag until the activity ended, the pumps were turned off and the caps were replaced.

2.7.2 Primary Field Calibration of Air Sampling Pumps and Rotameters

A BIOS Intl. DryCal DC-Lite™ model MH air-flow calibrator with a range of 0.2 LPM to 17 LPM was used to calibrate each of the rotameters used to set and confirm air sampling pump flow rates in the field. The DC-Lite™ automatically adjusts for temperature and pressure, eliminating the need for manual compensation or correction of flow-rate values. A calibration graph was produced for each of the rotameters, over a range of flow rates, to allow directly-read flow rates measured with the rotameter to be quickly and easily converted to true values (as determined by the DC-Lite™). Each rotameter was checked against the DC-Lite™ at the start and end of each day's ABS; measured flow rates were found to be very consistent, with less than 2.5-percent variation.

2.7.3 Secondary Field Calibration of Air Sampling Pumps

The flow rate of each air-sampling pump was measured, adjusted (if necessary) and recorded at the beginning of each ABS activity, and measured and recorded at the conclusion of each activity. The flow-rate measurement procedure consisted of using a rotameter connected by 8 inches of Tygon™ tubing to a dedicated cassette end cap, which was inserted into the intake (cowl) end of the sampling cassette. The pump was turned on for a brief period and the pump flow rate was adjusted as close to the target flow rate (4.0 LPM or 2.0 LPM, as appropriate) as possible, using the flow-rate value indicated by the center of the rotameter ball and converting to the true flow-rate value indicated on the calibration graph. The dedicated calibration equipment (cassette cap, rotameter and Tygon tubing) was stored in a closed Ziploc™ plastic bag when not in use.

The AirChek XR5000™ pumps used in the ABS program are equipped with isothermal flow sensors that measure air flow directly. The pump is electronically controlled to

deliver flow to within 5 percent of the flow set-point, and will automatically shut off and display a flow fault if the flow rate cannot be maintained (due to battery failure, crimped air sampling tubing, pump fault, etc.). The pumps used during Phase III ABS were observed to consistently deliver flow rates with less than 2.5-percent variation. The Airchek XR5000™ is driven by an internal lithium-ion battery; during periodic battery conditioning run-down, the pumps were observed to run continuously for as long as 96 hours, with no observed variation in flow rate (more than double the running life claimed by the manufacturer).

2.8 QUALITY CONTROL SAMPLES

2.8.1 Lot Blanks

Before any air cassettes were used for ABS, the cassette lot was verified to be asbestos-free. This was accomplished by sending two unopened cassettes per lot of cassettes for TEM analysis using ISO 10312 counting protocols, as modified by Libby-specific laboratory modifications. All lot blanks submitted during ABS in 2009 were analyzed as “ND” (non-detect) by the project analytical laboratory (Hygeia Laboratories of Sierra Madre, California).

2.8.2 Field Blanks

A field blank for ambient air was prepared by removing the sampling cassette from the shipping box, opening the cassette to the air in the area where the ABS samples were to be taken, then closing the cassette and packaging for shipment and analysis. Field blanks for ambient air were collected at a rate of one for each ABS round; each field blank was collected at a different ABS location.

2.9 SAMPLE HANDLING

At the time of collection, each sample was labeled with a unique 5-digit sequential index identification (index ID) number. The index IDs for all samples collected as part of

Phase III sampling have a prefix of "P3" (e.g., P3-12345). Information on whether the sample was representative of a field sample or a field-based QC sample (e.g., field blank) was documented on the FSDS.

The ABS director maintained a field logbook with sequentially-numbered, non-removable pages. Information on sampling activities and conditions that was not otherwise recorded on the FSDS forms was recorded in the field logbook. Scans of the FSDS and field logbooks are contained in Appendix B and C, respectively (on CD in pocket).

2.9.1 Sample Containers

ABS samples were collected using cowl, 25-mm diameter, 0.8- μ m pore size microcellulose ester (MCE), conductive filter cassettes supplied by EMSL Laboratories of Westmont, New Jersey. The sample cassettes remained capped until immediately before the pump was turned on and the ABS activity began. Cassettes were capped immediately after the activity ended and the pump was turned off.

2.9.2 Sample Preservation and Storage

Fresh sampling cassettes were stored in the partitioned cassette shipping box, with end caps on. At the conclusion of each sampling activity, the cassettes were re-capped and returned to the shipping box. Used cassettes were stored cowl-end-up to prevent particles from being dislodged from the filter media during transit. Because there are no special preservation requirements or holding times for asbestos samples, the cassettes were stored at ambient conditions, under custody of the ABS director.

2.10 SAMPLE DOCUMENTATION AND IDENTIFICATION

Field data observed during collection of each ABS sample were documented by the ABS director on OU3 Phase III RI-specific FSDS. At the time of collection, each sample was assigned a unique index ID number using pre-printed adhesive labels supplied by SRC. The index ID labels were provided in quadruplicate; one label was attached to the sample

cassette, another was placed on the FSDS and a third was placed in the field logbook (the fourth label was reserved for use in re-labeling, if necessary). Index IDs for all samples collected as part of the Phase III ABS bear the prefix of "P3" (e.g., P3-12345). Information on whether the sample is representative of a field sample or a field-based QC sample (e.g., field blank) was documented on the FSDS, but was not included on the chain-of-custody, to ensure that the sample type was unknown to the analytical laboratory.

Each field sampling team maintained a field logbook with sequentially numbered, non-removable pages. All potentially relevant information not recorded on the FSDS forms was recorded in the field logbook. Scans of the ABS logbook and FSDS forms are provided as PDF files in the Appendix B and C, respectively (on CD in pocket).

2.11 SAMPLE CHAIN-OF-CUSTODY AND SHIPMENT

Chain-of-custody (COC) was maintained until final disposition of the samples by the laboratory and acceptance of analytical results. A COC form specific to the Phase III ABS program accompanied every shipment of samples to the analytical laboratory. All corrections to the COC record were initialed and dated by the person who made the corrections. Original COCs accompanied the samples to the laboratory; copies were made and retained to document each change of custody. All samples were sent directly to the analytical laboratory by FedEx priority overnight service. Scans of the ABS COCs are provided as PDF files in Appendix D (on CD in pocket).

2.12 ANALYSIS

All samples collected during Phase III ABS were submitted for asbestos analysis using transmission electron microscopy (TEM) in accordance with the International Organization for Standardization (ISO) 10312:1995 method counting protocols, as modified by Libby-specific laboratory modifications. Detailed descriptions of laboratory protocols and analytical methods are provided in the Phase III SAP and associated standard operating procedures.

2.13 HEALTH AND SAFETY

“Tailgate” safety meetings for all ABS team members were conducted by an ABS director at the start of each day’s work. Bear deterrent spray, first-aid kits, cooling vests (during hot weather) and water were carried in the ABS team vehicles and made available for use by team members during project work.

ABS participants were equipped with Level C personal protective equipment (PPE) consisting of two sets of hooded Tyvek™ coveralls, full-face respirator, nitrile gloves and latex boot covers. Respirators were fitted with P100 high-efficiency particulate-air (HEPA) filter cartridges.

Because ABS was performed in remote areas far from the project decontamination facility, the outer layer of ABS participants’ PPE was rinsed thoroughly with water from a pressure-washer before they removed their PPE at the ABS base station. Coveralls, boot covers and gloves were disposed of after one use; fresh PPE was donned for ABS at each location, and before each campfire building/burning activity (which was performed at a dedicated burning ground outside the forest). All equipment (trucks, trailers, shovels, etc.) was decontaminated by pressure-washing between each ABS location, and before being transported off forest lands and onto paved roads.

TABLE 2-1
ACTIVITY BASED SAMPLING SUMMARY
ROUND 1, AUGUST 24-28, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-00451	P3-00455	P3-00459
		2.0 Lpm	P3-00452	P3-00456	P3-00460
	Person 2	4.0 Lpm	P3-00453	P3-00457	P3-00461
		2.0 Lpm	P3-00454	P3-00458	P3-00462
ABS-02	Person 1	4.0 Lpm	P3-00481	P3-00485	P3-00489
		2.0 Lpm	P3-00482	P3-00486	P3-00490
	Person 2	4.0 Lpm	P3-00483	P3-00487	P3-00491
		2.0 Lpm	P3-00484	P3-00488	P3-00492
ABS-03	Person 1	4.0 Lpm	P3-00493	P3-00497	P3-00501
		2.0 Lpm	P3-00494	P3-00498	P3-00502
	Person 2	4.0 Lpm	P3-00495	P3-00499	P3-00503
		2.0 Lpm	P3-00496	P3-00500	P3-00504
ABS-05	Person 1	4.0 Lpm	P3-00505	P3-00509	P3-00513
		2.0 Lpm	P3-00506	P3-00510	P3-00514
	Person 2	4.0 Lpm	P3-00507	P3-00511	P3-00515
		2.0 Lpm	P3-00508	P3-00512	P3-00516
ABS-06	Person 1	4.0 Lpm	P3-00559	P3-00563	P3-00568
		2.0 Lpm	P3-00560	P3-00564	P3-00569
	Person 2	4.0 Lpm	P3-00561	P3-00565	P3-00570
		2.0 Lpm	P3-00562	P3-00566	P3-00571
	Field Blank		P3-00567		
ABS-07	Person 1	4.0 Lpm	P3-00479	P3-00551	P3-00555
		2.0 Lpm	P3-00480	P3-00552	P3-00556
	Person 2	4.0 Lpm	P3-00549	P3-00553	P3-00557
		2.0 Lpm	P3-00550	P3-00554	P3-00558
ABS-08	Person 1	4.0 Lpm	P3-00475	P3-00541	P3-00545
		2.0 Lpm	P3-00476	P3-00542	P3-00546
	Person 2	4.0 Lpm	P3-00477	P3-00543	P3-00547
		2.0 Lpm	P3-00478	P3-00544	P3-00548
ABS-10	Person 1	4.0 Lpm	P3-00517	P3-00521	P3-00525
		2.0 Lpm	P3-00518	P3-00522	P3-00526
	Person 2	4.0 Lpm	P3-00519	P3-00523	P3-00527
		2.0 Lpm	P3-00520	P3-00524	P3-00528
ABS-11	Person 1	4.0 Lpm	P3-00463	P3-00467	P3-00471
		2.0 Lpm	P3-00464	P3-00468	P3-00472
	Person 2	4.0 Lpm	P3-00465	P3-00469	P3-00473
		2.0 Lpm	P3-00466	P3-00470	P3-00474
ABS-13	Person 1	4.0 Lpm	P3-00529	P3-00533	P3-00537
		2.0 Lpm	P3-00530	P3-00534	P3-00538
	Person 2	4.0 Lpm	P3-00531	P3-00535	P3-00539
		2.0 Lpm	P3-00532	P3-00536	P3-00540
ABS-14	Person 1	4.0 Lpm	P3-00572	P3-005576	P3-00580
		2.0 Lpm	P3-00573	P3-005577	P3-00581
	Person 2	4.0 Lpm	P3-00574	P3-005578	P3-00582
		2.0 Lpm	P3-00575	P3-005579	P3-00583

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-2
ACTIVITY BASED SAMPLING SUMMARY
ROUND 2, AUGUST 31-SEPTEMBER 4, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-00733	P3-00737	P3-00741
		2.0 Lpm	P3-00734	P3-00738	P3-00742
	Person 2	4.0 Lpm	P3-00735	P3-00739	P3-00743
		2.0 Lpm	P3-00736	P3-00740	P3-00744
ABS-02	Person 1	4.0 Lpm	P3-00721	P3-00725	P3-00729
		2.0 Lpm	Table 2-2	P3-00726	P3-00730
	Person 2	4.0 Lpm	P3-00723	P3-00727	P3-00731
		2.0 Lpm	P3-00724	P3-00728	P3-00732
ABS-03	Person 1	4.0 Lpm	P3-00605	P3-00609	P3-00613
		2.0 Lpm	P3-00606	P3-00610	P3-00614
	Person 2	4.0 Lpm	P3-00607	P3-00611	P3-00615
		2.0 Lpm	P3-00608	P3-00612	P3-00616
ABS-05	Person 1	4.0 Lpm	P3-00617	P3-00621	P3-00625
		2.0 Lpm	P3-00618	P3-00622	P3-00626
	Person 2	4.0 Lpm	P3-00619	P3-00623	P3-00627
		2.0 Lpm	P3-00620	P3-00624	P3-00628
ABS-06	Person 1	4.0 Lpm	P3-00629	P3-00633	P3-00637
		2.0 Lpm	P3-00630	P3-00634	P3-00638
	Person 2	4.0 Lpm	P3-00631	P3-00635	P3-00639
		2.0 Lpm	P3-00632	P3-00636	P3-00640
ABS-07	Person 1	4.0 Lpm	P3-00641	P3-00645	P3-00649
		2.0 Lpm	P3-00642	P3-00646	P3-00650
	Person 2	4.0 Lpm	P3-00643	P3-00647	P3-00651
		2.0 Lpm	P3-00644	P3-00648	P3-00652
ABS-08	Person 1	4.0 Lpm	P3-00745	P3-00749	P3-00754
		2.0 Lpm	P3-00746	P3-00750	P3-00755
	Person 2	4.0 Lpm	P3-00747	P3-00751	P3-00756
		2.0 Lpm	P3-00748	P3-00752	P3-00757
	Field Blank		P3-00753		
ABS-10	Person 1	4.0 Lpm	P3-00770	P3-00774	P3-00778
		2.0 Lpm	P3-00771	P3-00775	P3-00779
	Person 2	4.0 Lpm	P3-00772	P3-00776	P3-00780
		2.0 Lpm	P3-00773	P3-00777	P3-00781
ABS-11	Person 1	4.0 Lpm	P3-00758	P3-00762	P3-00766
		2.0 Lpm	P3-00759	P3-00763	P3-00767
	Person 2	4.0 Lpm	P3-00760	P3-00764	P3-00768
		2.0 Lpm	P3-00761	P3-00765	P3-00769
ABS-13	Person 1	4.0 Lpm	P3-00784	P3-00788	P3-00792
		2.0 Lpm	P3-00785	P3-00789	P3-00793
	Person 2	4.0 Lpm	P3-00786	P3-00790	P3-00794
		2.0 Lpm	P3-00787	P3-00791	P3-00795
ABS-14	Person 1	4.0 Lpm	P3-00661	P3-00665	P3-00669
		2.0 Lpm	P3-00662	P3-00666	P3-00670
	Person 2	4.0 Lpm	P3-00663	P3-00667	P3-00671
		2.0 Lpm	P3-00664	P3-00668	P3-00672

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-3
ACTIVITY BASED SAMPLING SUMMARY
ROUND 3, SEPTEMBER 7-11, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-00820	P3-00812	P3-00816
		2.0 Lpm	P3-00821	P3-00813	P3-00817
	Person 2	4.0 Lpm	P3-00822	P3-00814	P3-00818
		2.0 Lpm	P3-00823	P3-00815	P3-00819
	Field Blank		P3-00824		
ABS-02	Person 1	4.0 Lpm	P3-00808	P3-00800	P3-00804
		2.0 Lpm	P3-00809	P3-00801	P3-00805
	Person 2	4.0 Lpm	P3-00810	P3-00802	P3-00806
		2.0 Lpm	P3-00811	P3-00803	P3-00807
ABS-03	Person 1	4.0 Lpm	P3-00597	P3-00673	P3-00677
		2.0 Lpm	P3-00598	P3-00674	P3-00678
	Person 2	4.0 Lpm	P3-00599	P3-00675	P3-00679
		2.0 Lpm	P3-00600	P3-00676	P3-00680
ABS-05	Person 1	4.0 Lpm	P3-00585	P3-00589	P3-00593
		2.0 Lpm	P3-00586	P3-00590	P3-00594
	Person 2	4.0 Lpm	P3-00587	P3-00591	P3-00595
		2.0 Lpm	P3-00588	P3-00592	P3-00596
ABS-06	Person 1	4.0 Lpm	P3-00865	P3-00869	P3-00873
		2.0 Lpm	P3-00866	P3-00870	P3-00874
	Person 2	4.0 Lpm	P3-00867	P3-00871	P3-00875
		2.0 Lpm	P3-00868	P3-00872	P3-00876
ABS-07	Person 1	4.0 Lpm	P3-00877	P3-00881	P3-00885
		2.0 Lpm	P3-00878	P3-00882	P3-00886
	Person 2	4.0 Lpm	P3-00879	P3-00883	P3-00887
		2.0 Lpm	P3-00880	P3-00884	P3-00888
ABS-08	Person 1	4.0 Lpm	P3-00705	P3-00701	P3-00709
		2.0 Lpm	P3-00706	P3-00702	P3-00710
	Person 2	4.0 Lpm	P3-00707	P3-00703	P3-00711
		2.0 Lpm	P3-00708	P3-00704	P3-00712
ABS-10	Person 1	4.0 Lpm	P3-00833	P3-00825	P3-00829
		2.0 Lpm	P3-00834	P3-00826	P3-00830
	Person 2	4.0 Lpm	P3-00835	P3-00827	P3-00831
		2.0 Lpm	P3-00836	P3-00828	P3-00832
ABS-11	Person 1	4.0 Lpm	P3-00713	P3-00717	P3-00861
		2.0 Lpm	P3-00714	P3-00718	P3-00862
	Person 2	4.0 Lpm	P3-00715	P3-00719	P3-00863
		2.0 Lpm	P3-00716	P3-00720	P3-00864
ABS-13	Person 1	4.0 Lpm	P3-00845	P3-00837	P3-00841
		2.0 Lpm	P3-00846	P3-00838	P3-00842
	Person 2	4.0 Lpm	P3-00847	P3-00839	P3-00843
		2.0 Lpm	P3-00848	P3-00840	P3-00844
ABS-14	Person 1	4.0 Lpm	P3-00849	P3-00853	P3-00857
		2.0 Lpm	P3-00850	P3-00854	P3-00858
	Person 2	4.0 Lpm	P3-00851	P3-00855	P3-00859
		2.0 Lpm	P3-00852	P3-00856	P3-00860

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-4
ACTIVITY BASED SAMPLING SUMMARY
ROUND 4, SEPTEMBER 14-18, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-01001	P3-01005	P3-01009
		2.0 Lpm	P3-01002	P3-01006	P3-01010
	Person 2	4.0 Lpm	P3-01003	P3-01007	P3-01011
		2.0 Lpm	P3-01004	P3-01008	P3-01012
ABS-02	Person 1	4.0 Lpm	P3-01013	P3-01017	P3-01021
		2.0 Lpm	P3-01014	P3-01018	P3-01022
	Person 2	4.0 Lpm	P3-01015	P3-01019	P3-01023
		2.0 Lpm	P3-01016	P3-01020	P3-01024
ABS-03	Person 1	4.0 Lpm	P3-00901	P3-00905	P3-00909
		2.0 Lpm	P3-00902	P3-00906	P3-00910
	Person 2	4.0 Lpm	P3-00903	P3-00907	P3-00911
		2.0 Lpm	P3-00904	P3-00908	P3-00912
ABS-05	Person 1	4.0 Lpm	P3-00913	P3-00917	P3-00921
		2.0 Lpm	P3-00914	P3-00918	P3-00922
	Person 2	4.0 Lpm	P3-00915	P3-00919	P3-00923
		2.0 Lpm	P3-00916	P3-00920	P3-00924
ABS-06	Person 1	4.0 Lpm	P3-01025	P3-01029	P3-01033
		2.0 Lpm	P3-01026	P3-01030	P3-01034
	Person 2	4.0 Lpm	P3-01027	P3-01031	P3-01035
		2.0 Lpm	P3-01028	P3-01032	P3-01036
ABS-07	Person 1	4.0 Lpm	P3-01037	P3-01041	P3-01045
		2.0 Lpm	P3-01038	P3-01042	P3-01046
	Person 2	4.0 Lpm	P3-01039	P3-01043	P3-01047
		2.0 Lpm	P3-01040	P3-01044	P3-01048
ABS-08	Person 1	4.0 Lpm	P3-00925	P3-00929	P3-00933
		2.0 Lpm	P3-00926	P3-00930	P3-00934
	Person 2	4.0 Lpm	P3-00927	P3-00931	P3-00935
		2.0 Lpm	P3-00928	P3-00932	P3-00936
ABS-10	Person 1	4.0 Lpm	P3-00957	P3-00949	P3-00953
		2.0 Lpm	P3-00958	P3-00950	P3-00954
	Person 2	4.0 Lpm	P3-00959	P3-00951	P3-00955
		2.0 Lpm	P3-00960	P3-00952	P3-00956
ABS-11	Person 1	4.0 Lpm	P3-00937	P3-00941	P3-00945
		2.0 Lpm	P3-00938	P3-00942	P3-00946
	Person 2	4.0 Lpm	P3-00939	P3-00943	P3-00947
		2.0 Lpm	P3-00940	P3-00944	P3-00948
ABS-13	Person 1	4.0 Lpm	P3-01049	P3-01053	P3-01057
		2.0 Lpm	P3-01050	P3-01054	P3-01058
	Person 2	4.0 Lpm	P3-01051	P3-01055	P3-01059
		2.0 Lpm	P3-01052	P3-01056	P3-01060
	Field Blank		P3-01073		
ABS-14	Person 1	4.0 Lpm	P3-01061	P3-01065	P3-01069
		2.0 Lpm	P3-01062	P3-01066	P3-01070
	Person 2	4.0 Lpm	P3-01063	P3-01067	P3-01071
		2.0 Lpm	P3-01064	P3-01068	P3-01072

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-5
ACTIVITY BASED SAMPLING SUMMARY
ROUND 5, SEPTEMBER 21-25, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-01074	P3-01078	P3-01082
		2.0 Lpm	P3-01075	P3-01079	P3-01083
	Person 2	4.0 Lpm	P3-01076	P3-01080	P3-01084
		2.0 Lpm	P3-01077	P3-01081	P3-01085
ABS-02	Person 1	4.0 Lpm	P3-00969	P3-00961	P3-00965
		2.0 Lpm	P3-00970	P3-00962	P3-00966
	Person 2	4.0 Lpm	P3-00971	P3-00963	P3-00967
		2.0 Lpm	P3-00972	P3-00964	P3-00968
ABS-03	Person 1	4.0 Lpm	P3-01158	P3-01150	P3-01154
		2.0 Lpm	P3-01159	P3-01151	P3-01155
	Person 2	4.0 Lpm	P3-01160	P3-01152	P3-01156
		2.0 Lpm	P3-01161	P3-01153	P3-01157
ABS-05	Person 1	4.0 Lpm	P3-00982	P3-00973	P3-00978
		2.0 Lpm	P3-00983	P3-00974	P3-00979
	Person 2	4.0 Lpm	P3-00984	P3-00975	P3-00980
		2.0 Lpm	P3-00985	P3-00976	P3-00981
	Field Blank		P3-00977		
ABS-06	Person 1	4.0 Lpm	P3-00889	P3-00893	P3-00897
		2.0 Lpm	P3-00890	P3-00894	P3-00898
	Person 2	4.0 Lpm	P3-00891	P3-00895	P3-00899
		2.0 Lpm	P3-00892	P3-00896	P3-00900
ABS-07	Person 1	4.0 Lpm	P3-00994	P3-00986	P3-00990
		2.0 Lpm	P3-00995	P3-00987	P3-00991
	Person 2	4.0 Lpm	P3-00996	P3-00988	P3-00992
		2.0 Lpm	P3-00997	P3-00989	P3-00993
ABS-08	Person 1	4.0 Lpm	P3-01098	P3-01103	P3-01107
		2.0 Lpm	P3-01099	P3-01104	P3-01108
	Person 2	4.0 Lpm	P3-01100	P3-01105	P3-01109
		2.0 Lpm	P3-01101	P3-01106	P3-01110
ABS-10	Person 1	4.0 Lpm	P3-01146	P3-00998	P3-01142
		2.0 Lpm	P3-01147	P3-00999	P3-01143
	Person 2	4.0 Lpm	P3-01148	P3-01000	P3-01144
		2.0 Lpm	P3-01149	P3-01141	P3-01145
ABS-11	Person 1	4.0 Lpm	P3-01111	P3-01115	P3-01119
		2.0 Lpm	P3-01112	P3-01116	P3-01120
	Person 2	4.0 Lpm	P3-01113	P3-01117	P3-01121
		2.0 Lpm	P3-01114	P3-01118	P3-01122
ABS-13	Person 1	4.0 Lpm	P3-01086	P3-01090	P3-01094
		2.0 Lpm	P3-01087	P3-01091	P3-01095
	Person 2	4.0 Lpm	P3-01088	P3-01092	P3-01096
		2.0 Lpm	P3-01089	P3-01093	P3-01097
ABS-14	Person 1	4.0 Lpm	P3-01123	P3-01127	P3-01131
		2.0 Lpm	P3-01124	P3-01128	P3-01132
	Person 2	4.0 Lpm	P3-01125	P3-01129	P3-01133
		2.0 Lpm	P3-01126	P3-01130	P3-01134

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-6
ACTIVITY BASED SAMPLING SUMMARY
ROUND 6, SEPTEMBER 28-OCTOBER 2, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-01201	P3-01205	P3-01209
		2.0 Lpm	P3-01202	P3-01206	P3-01210
	Person 2	4.0 Lpm	P3-01203	P3-01207	P3-01211
		2.0 Lpm	P3-01204	P3-01208	P3-01212
ABS-02	Person 1	4.0 Lpm	P3-01213	P3-01217	P3-01221
		2.0 Lpm	P3-01214	P3-01218	P3-01222
	Person 2	4.0 Lpm	P3-01215	P3-01219	P3-01223
		2.0 Lpm	P3-01216	P3-01220	P3-01224
ABS-03	Person 1	4.0 Lpm	P3-01170	P3-01162	P3-01166
		2.0 Lpm	P3-01171	P3-01163	P3-01167
	Person 2	4.0 Lpm	P3-01172	P3-01164	P3-01168
		2.0 Lpm	P3-01173	P3-01165	P3-01169
ABS-05	Person 1	4.0 Lpm	P3-01284	P3-01174	P3-01278
		2.0 Lpm	P3-01285	P3-01175	P3-01281
	Person 2	4.0 Lpm	P3-01286	P3-01176	P3-01282
		2.0 Lpm	P3-01287	P3-01177	P3-01283
ABS-06	Person 1	4.0 Lpm	P3-01296	P3-01288	P3-01292
		2.0 Lpm	P3-01297	P3-01289	P3-01293
	Person 2	4.0 Lpm	P3-01298	P3-01290	P3-01294
		2.0 Lpm	P3-01299	P3-01291	P3-01295
ABS-07	Person 1	4.0 Lpm	P3-01308	P3-01300	P3-01304
		2.0 Lpm	P3-01309	P3-01301	P3-01305
	Person 2	4.0 Lpm	P3-01310	P3-01302	P3-01306
		2.0 Lpm	P3-01311	P3-01303	P3-01307
ABS-08	Person 1	4.0 Lpm	P3-01320	P3-01312	P3-01316
		2.0 Lpm	P3-01321	P3-01313	P3-01317
	Person 2	4.0 Lpm	P3-01322	P3-01314	P3-01318
		2.0 Lpm	P3-01323	P3-01315	P3-01319
ABS-10	Person 1	4.0 Lpm	P3-01249	P3-01253	P3-01257
		2.0 Lpm	P3-01250	P3-01254	P3-01258
	Person 2	4.0 Lpm	P3-01251	P3-01255	P3-01259
		2.0 Lpm	P3-01252	P3-01256	P3-01260
	Field Blank		P3-01141		
ABS-11	Person 1	4.0 Lpm	P3-01332	P3-01324	P3-01328
		2.0 Lpm	P3-01333	P3-01325	P3-01329
	Person 2	4.0 Lpm	P3-01334	P3-01326	P3-01330
		2.0 Lpm	P3-01335	P3-01327	P3-01331
ABS-13	Person 1	4.0 Lpm	P3-01225	P3-01229	P3-01233
		2.0 Lpm	P3-01226	P3-01230	P3-01234
	Person 2	4.0 Lpm	P3-01227	P3-01231	P3-01235
		2.0 Lpm	P3-01228	P3-01232	P3-01236
ABS-14	Person 1	4.0 Lpm	P3-01237	P3-01241	P3-01245
		2.0 Lpm	P3-01238	P3-01242	P3-01246
	Person 2	4.0 Lpm	P3-01239	P3-01243	P3-01247
		2.0 Lpm	P3-01240	P3-01244	P3-01248

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-7
ACTIVITY BASED SAMPLING SUMMARY
ROUND 7, OCTOBER 5-9, 2009

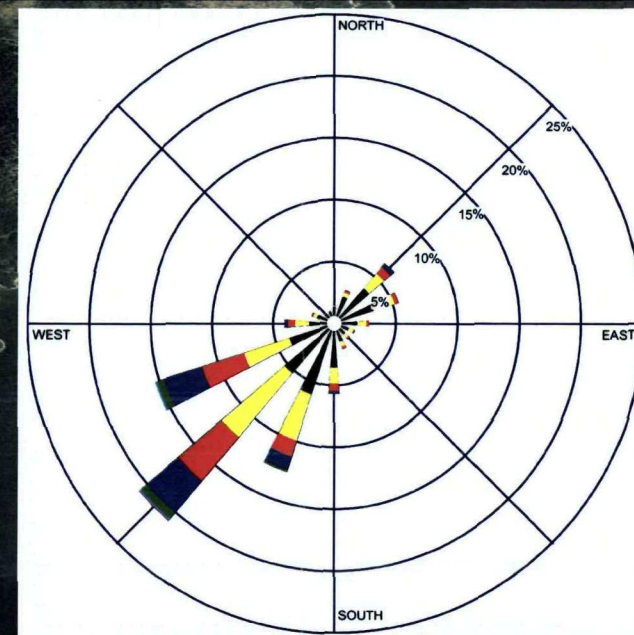
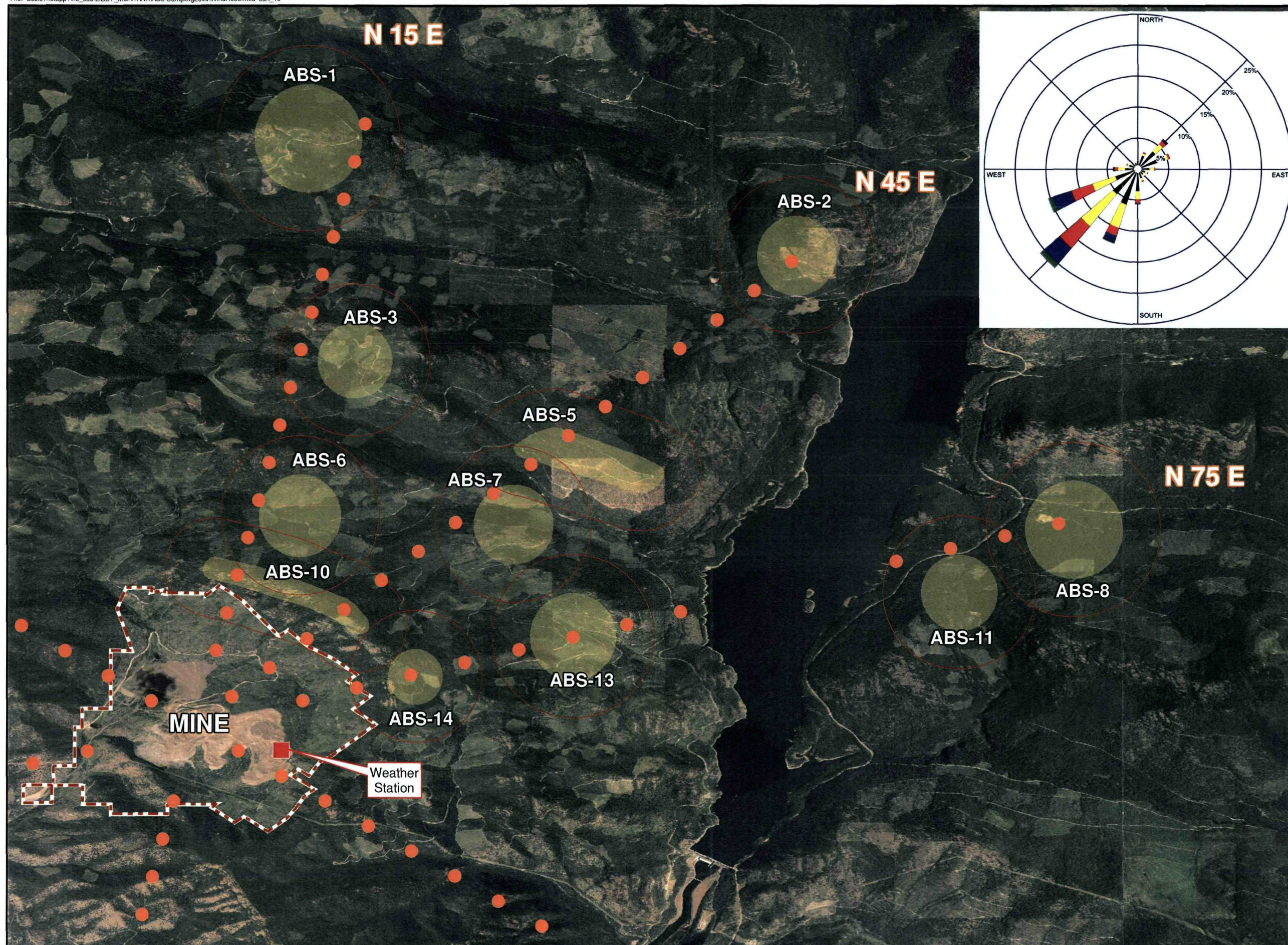
Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-01	Person 1	4.0 Lpm	P3-01261	P3-01265	P3-01269
		2.0 Lpm	P3-01262	P3-01266	P3-01270
	Person 2	4.0 Lpm	P3-01263	P3-01267	P3-01271
		2.0 Lpm	P3-01264	P3-01268	P3-01272
ABS-02	Person 1	4.0 Lpm	P3-01356	P3-01348	P3-01352
		2.0 Lpm	P3-01357	P3-01349	P3-01353
	Person 2	4.0 Lpm	P3-01358	P3-01350	P3-01354
		2.0 Lpm	P3-01359	P3-01351	P3-01355
	Field Blank		P3-01360		
ABS-03	Person 1	4.0 Lpm	P3-01344	P3-01336	P3-01340
		2.0 Lpm	P3-01345	P3-01337	P3-01341
	Person 2	4.0 Lpm	P3-01346	P3-01338	P3-01342
		2.0 Lpm	P3-01347	P3-01339	P3-01343
ABS-05	Person 1	4.0 Lpm	P3-01369	P3-01361	P3-01365
		2.0 Lpm	P3-01370	P3-01362	P3-01366
	Person 2	4.0 Lpm	P3-01371	P3-01363	P3-01367
		2.0 Lpm	P3-01372	P3-01364	P3-01368
ABS-06	Person 1	4.0 Lpm	P3-01381	P3-01373	P3-01377
		2.0 Lpm	P3-01382	P3-01374	P3-01378
	Person 2	4.0 Lpm	P3-01383	P3-01375	P3-01379
		2.0 Lpm	P3-01384	P3-01376	P3-01380
ABS-07	Person 1	4.0 Lpm	P3-01273	P3-01277	P3-01401
		2.0 Lpm	P3-01274	P3-01278	P3-01402
	Person 2	4.0 Lpm	P3-01275	P3-01279	P3-01403
		2.0 Lpm	P3-01276	P3-01280	P3-01404
ABS-13	Person 1	4.0 Lpm	P3-01405	P3-01409	P3-01413
		2.0 Lpm	P3-01406	P3-01410	P3-01414
	Person 2	4.0 Lpm	P3-01407	P3-01411	P3-01415
		2.0 Lpm	P3-01408	P3-01412	P3-01416
ABS-14	Person 1	4.0 Lpm	P3-01417	P3-01421	P3-01425
		2.0 Lpm	P3-01418	P3-01422	P3-01426
	Person 2	4.0 Lpm	P3-01419	P3-01423	P3-01427
		2.0 Lpm	P3-01420	P3-01424	P3-01428

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning

TABLE 2-8
ACTIVITY BASED SAMPLING SUMMARY
ROUND 8, NOVEMBER 9-11, 2009

Area		Flow	Index IDs		
			ATV Riding	Hiking	WG/FP/BU
ABS-02	Person 1	4.0 Lpm	P3-01393	P3-01385	P3-01389
		2.0 Lpm	P3-01394	P3-01386	P3-01390
	Person 2	4.0 Lpm	P3-01395	P3-01387	P3-01391
		2.0 Lpm	P3-01396	P3-01388	P3-01392
ABS-05	Person 1	4.0 Lpm	P3-01485	P3-01397	P3-01481
		2.0 Lpm	P3-01486	P3-01398	P3-01482
	Person 2	4.0 Lpm	P3-01487	P3-01399	P3-01483
		2.0 Lpm	P3-01488	P3-01400	P3-01484
ABS-07	Person 1	4.0 Lpm	P3-01441	P3-01445	P3-01449
		2.0 Lpm	P3-01442	P3-01446	P3-01450
	Person 2	4.0 Lpm	P3-01443	P3-01447	P3-01451
		2.0 Lpm	P3-01444	P3-01448	P3-01452

WG/FP/BU Composite Activities- wood gathering, fire-pit digging, wood burning



LEGEND

WIND SPEED (Knots)

- >= 45
- 30 - 45
- 22 - 30
- 17 - 21
- 11 - 17
- 7 - 11
- 4 - 7
- 1 - 4

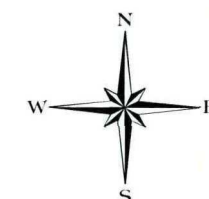
Calms: 12.77%

Wind Data
from December 2006 to February 2009

Mine Boundary

2007 Tree Bark, Duff and Soil Sampling Location

ABS Location Zones with outer 0.5 mile Buffer Zone



0 3,250 6,500 Feet

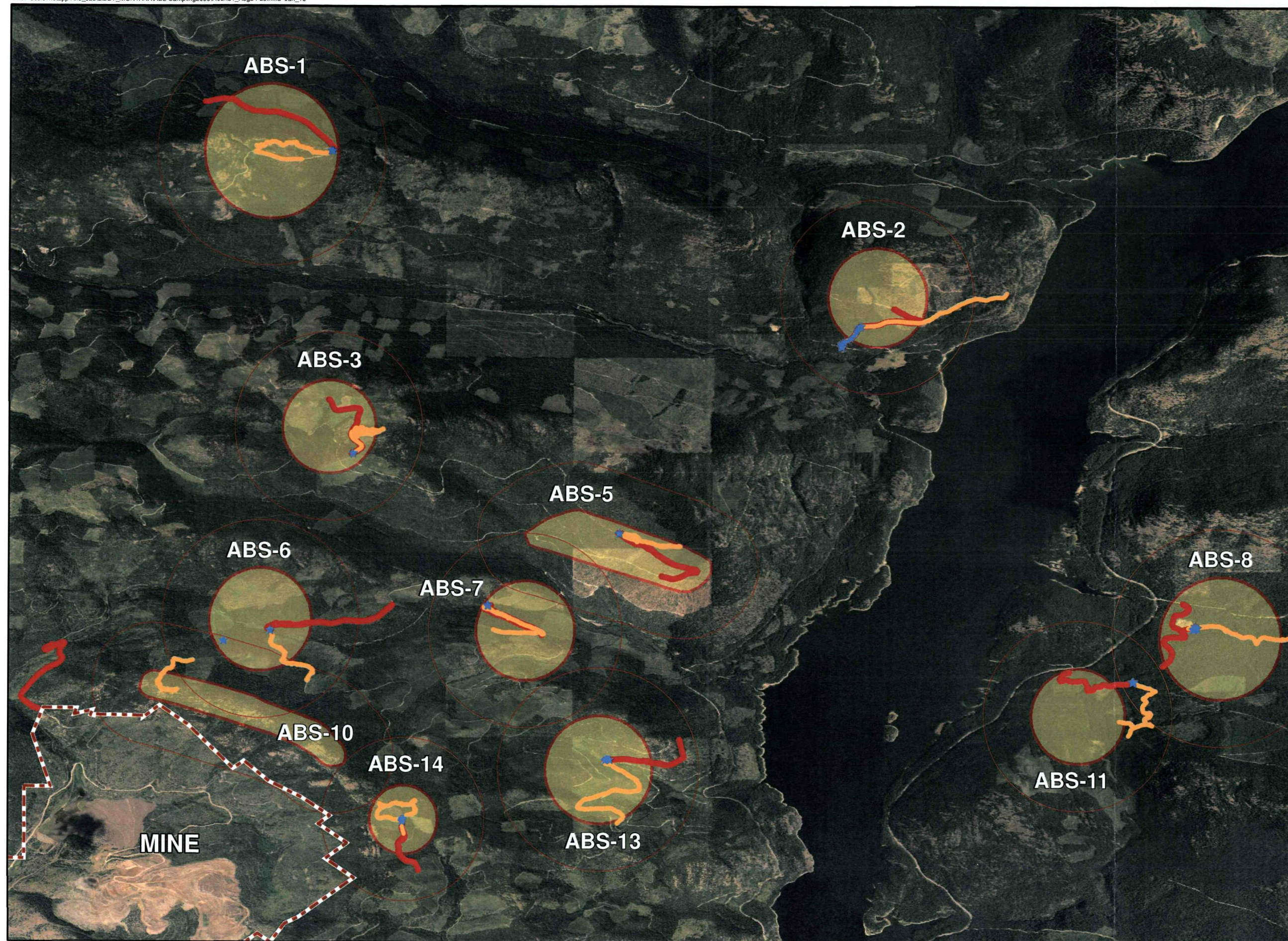
PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
PHASE I DOWNWIND SAMPLING
TRANSECTS and
PHASE III ABS LOCATIONS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:

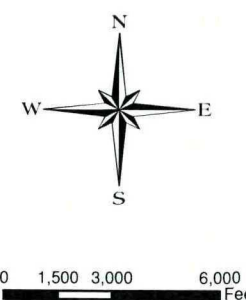
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2-1



LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- ★ WOOD GATHERING/ FIRE PIT
- HIKE
- ATV

ABS ROUND 1
August 24 - 28

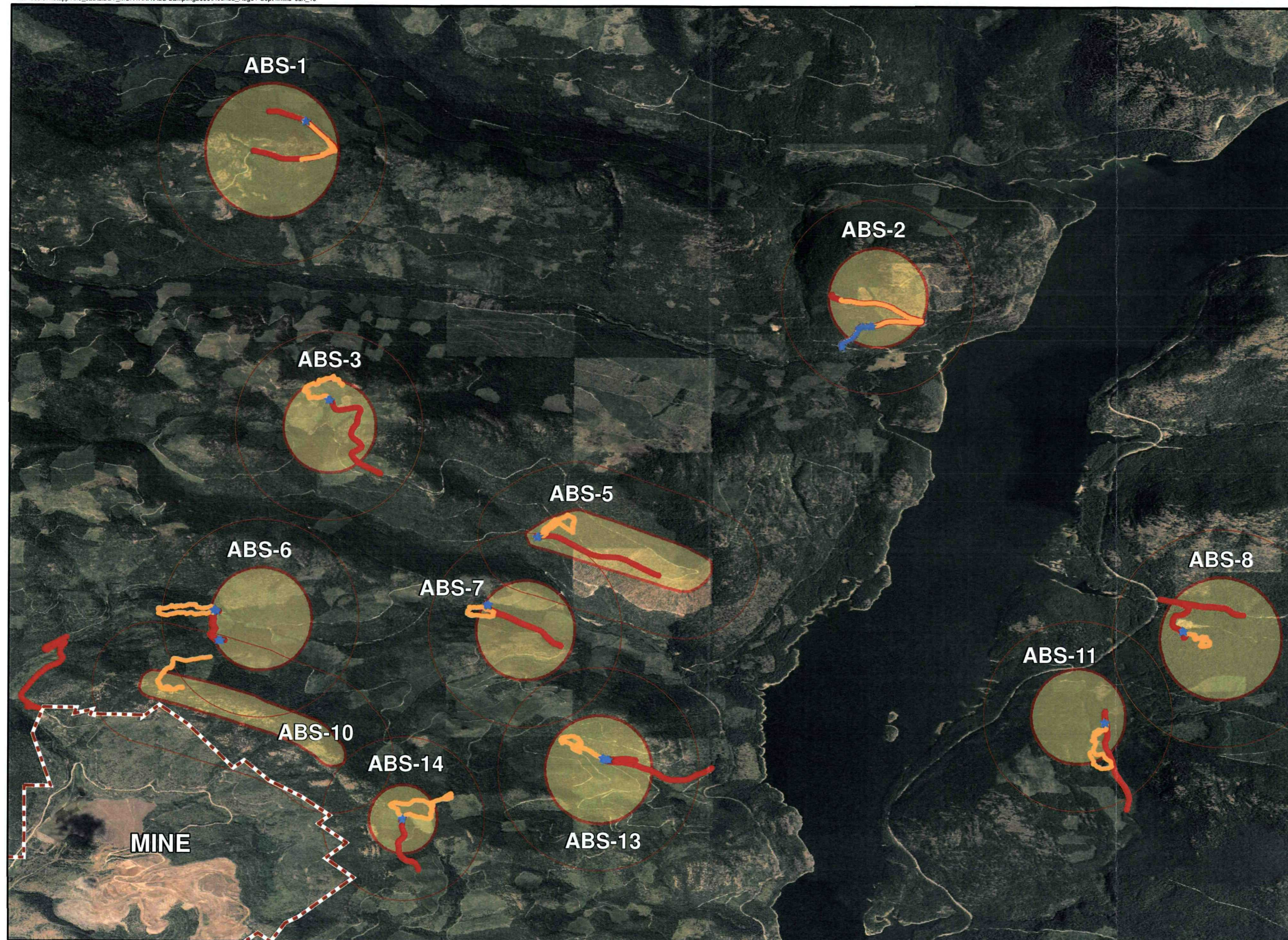


PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
ABS ROUND 1 GPS TRACKS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:
FIGURE NO:
2-2

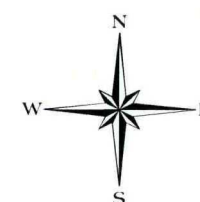


LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone

ABS ROUND 2
August 31 - September 4

- WOOD GATHERING/
FIRE PIT
- HIKE
- ATV



0 1,500 3,000 6,000 Feet

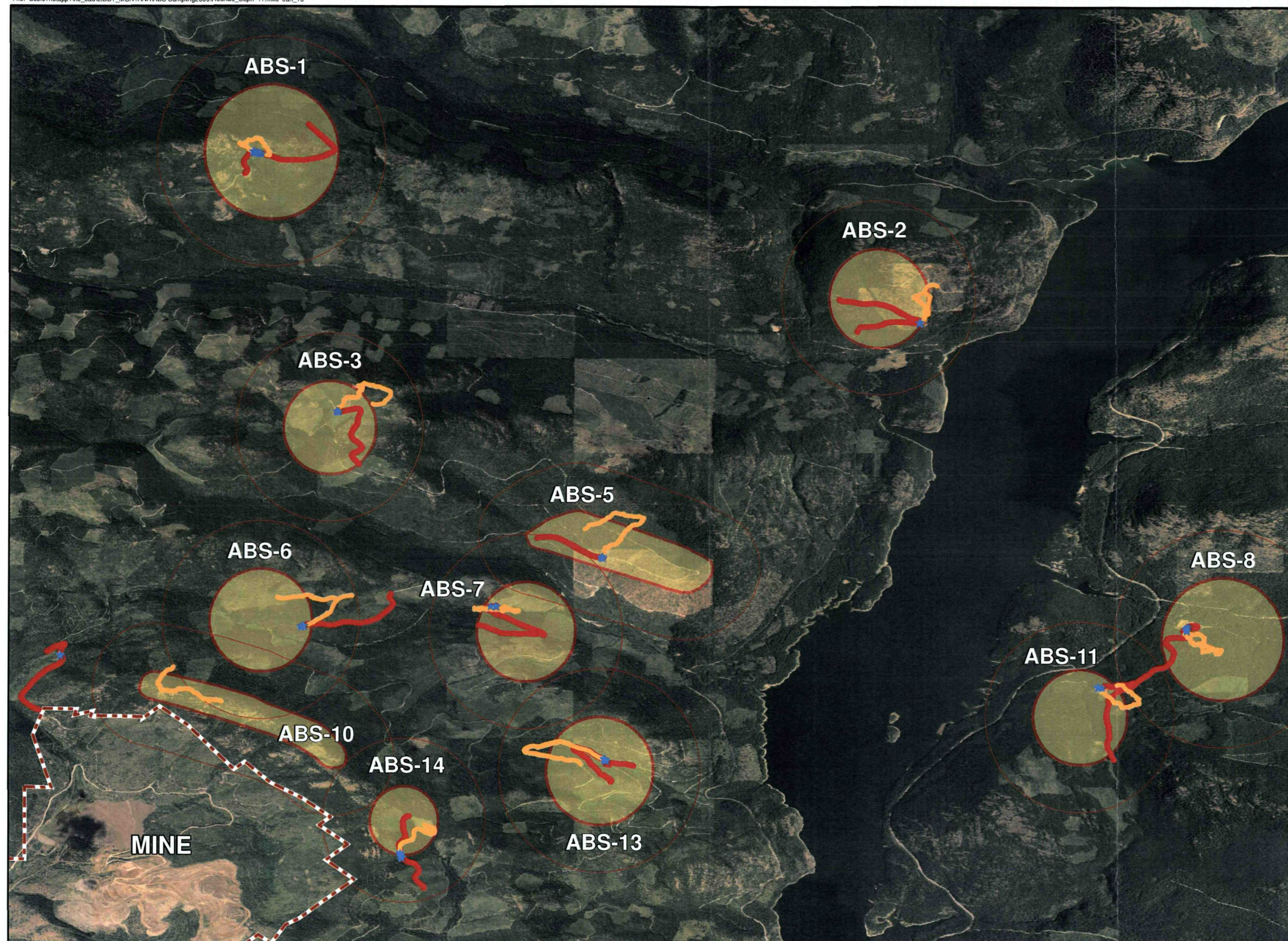
PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
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10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:

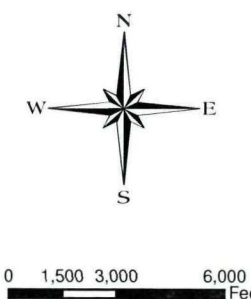
FIGURE NO:
2-3



LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- WOOD GATHERING/FIRE PIT
- HIKE
- ATV

ABS ROUND 3
September 7 - 11

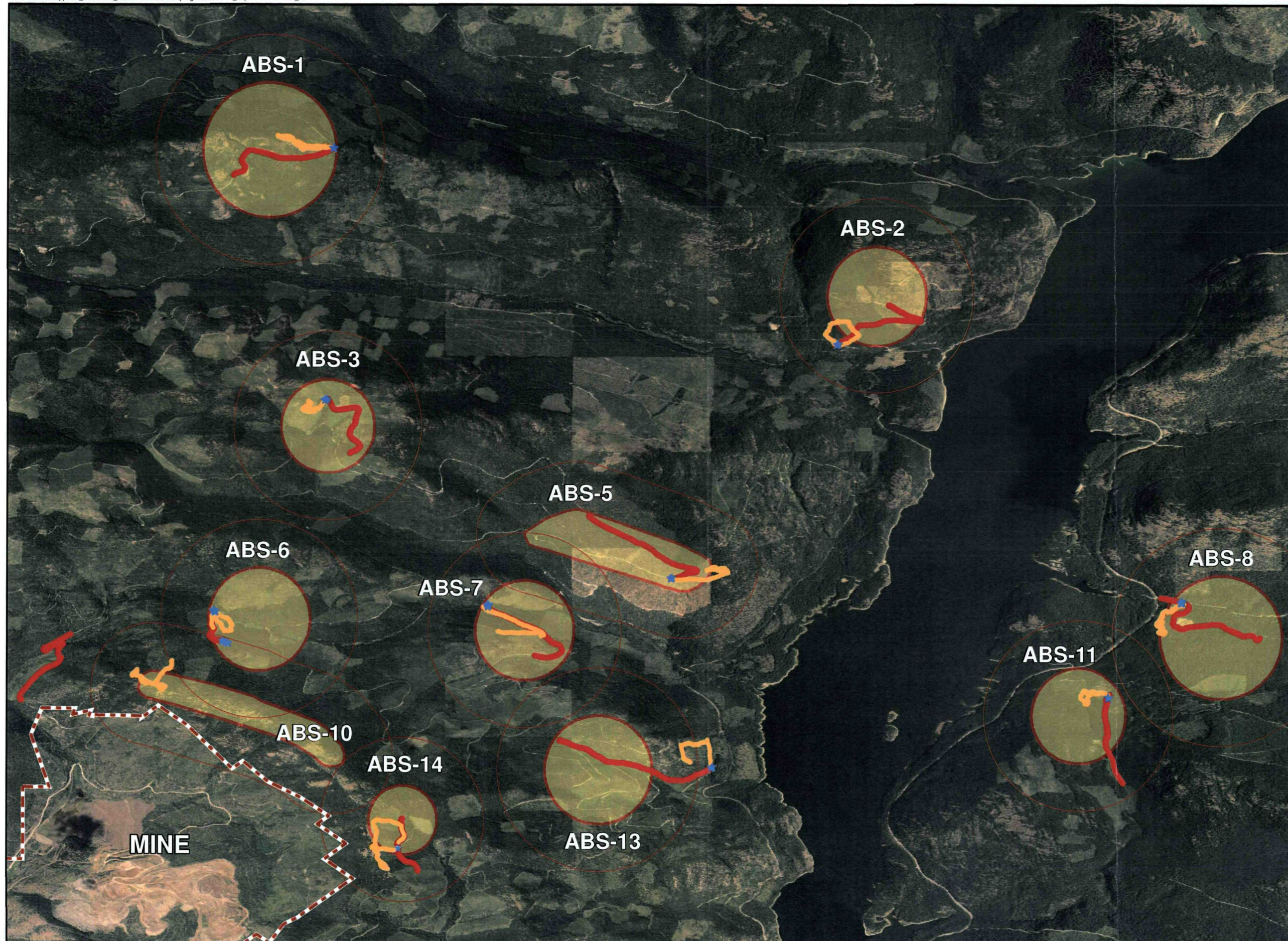


PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
ABS ROUND 3 GPS TRACKS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

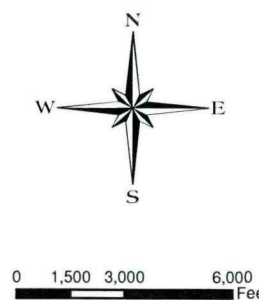
Date: 01/11/10
Rev:
FIGURE NO:
2-4



LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- WOOD GATHERING/ FIRE PIT
- HIKE
- ATV

ABS ROUND 4
September 14 - 18

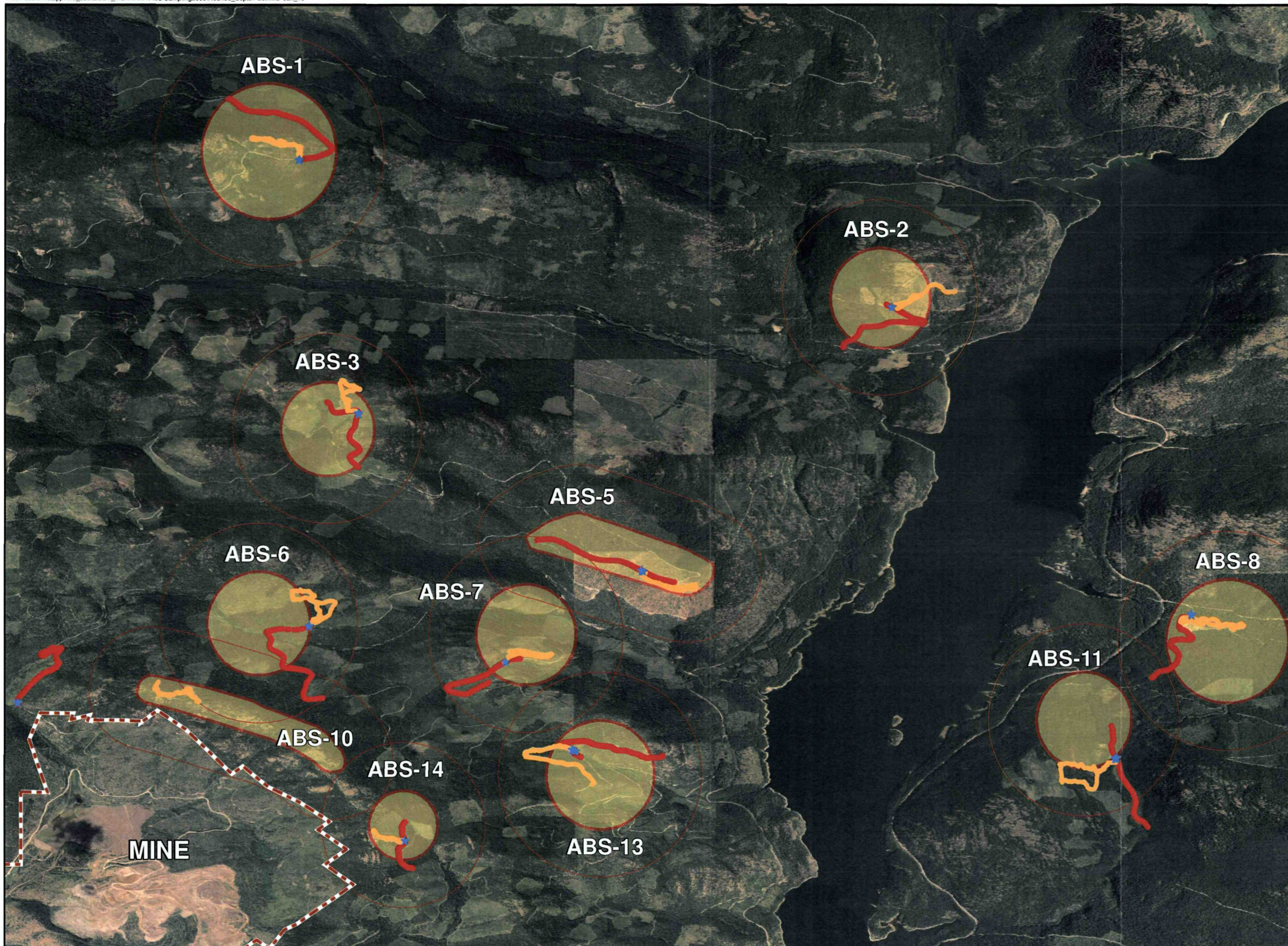


PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
ABS ROUND 4 GPS TRACKS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

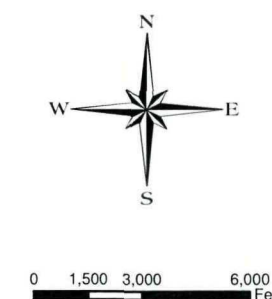
Date: 01/11/10
Rev:
FIGURE NO:
2-5



LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- ★ WOOD GATHERING/ FIRE PIT
- HIKE
- ATV

ABS ROUND 5
September 21 - 25

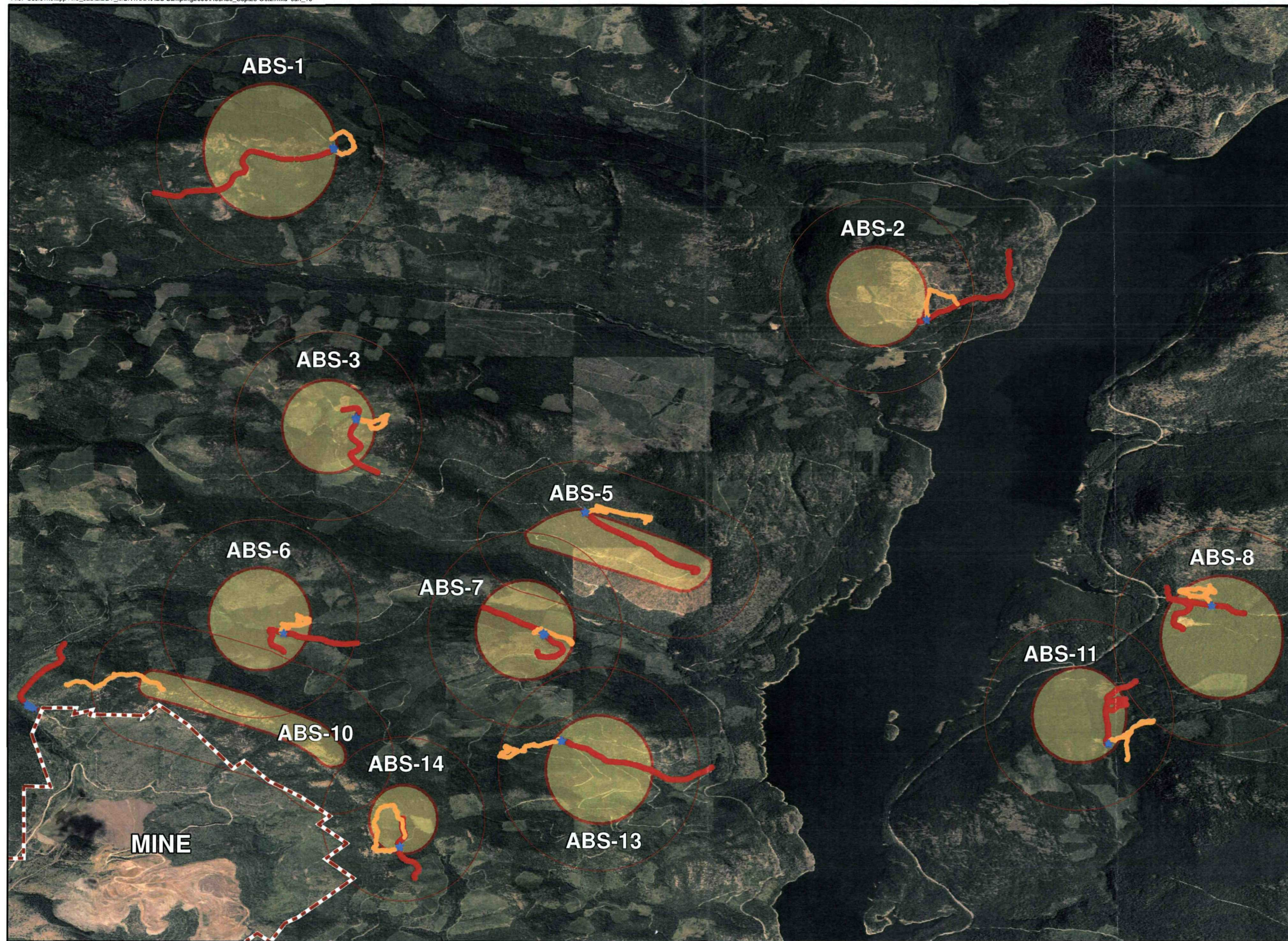


PROJECT: W. R Grace
Libby, Montana






FIGURE TITLE:
ABS ROUND 5 GPS TRACKS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:
FIGURE NO:
2-6



LEGEND

-  Mine Boundary
-  ABS Location Zones with outer 0.5 mile Buffer Zone
-  WOOD GATHERING/FIRE PIT
-  HIKE
-  ATV

ABS ROUND 6
September 28 - October 2



0 1,500 3,000 6,000
Feet

PROJECT: W. R Grace
Libby, Montana

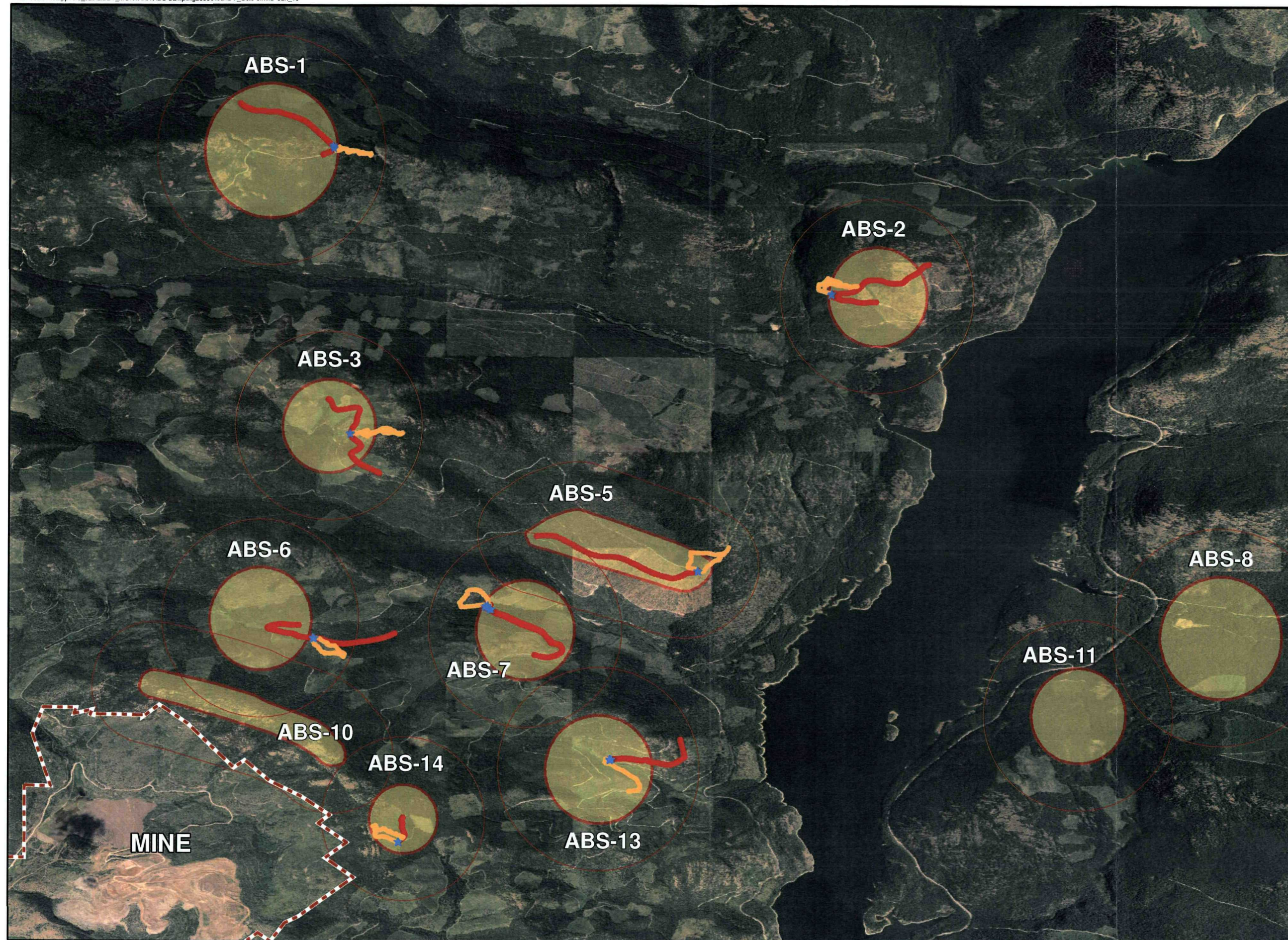
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ABS ROUND 6 GPS TRACKS



10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:

FIGURE NO:
2-7



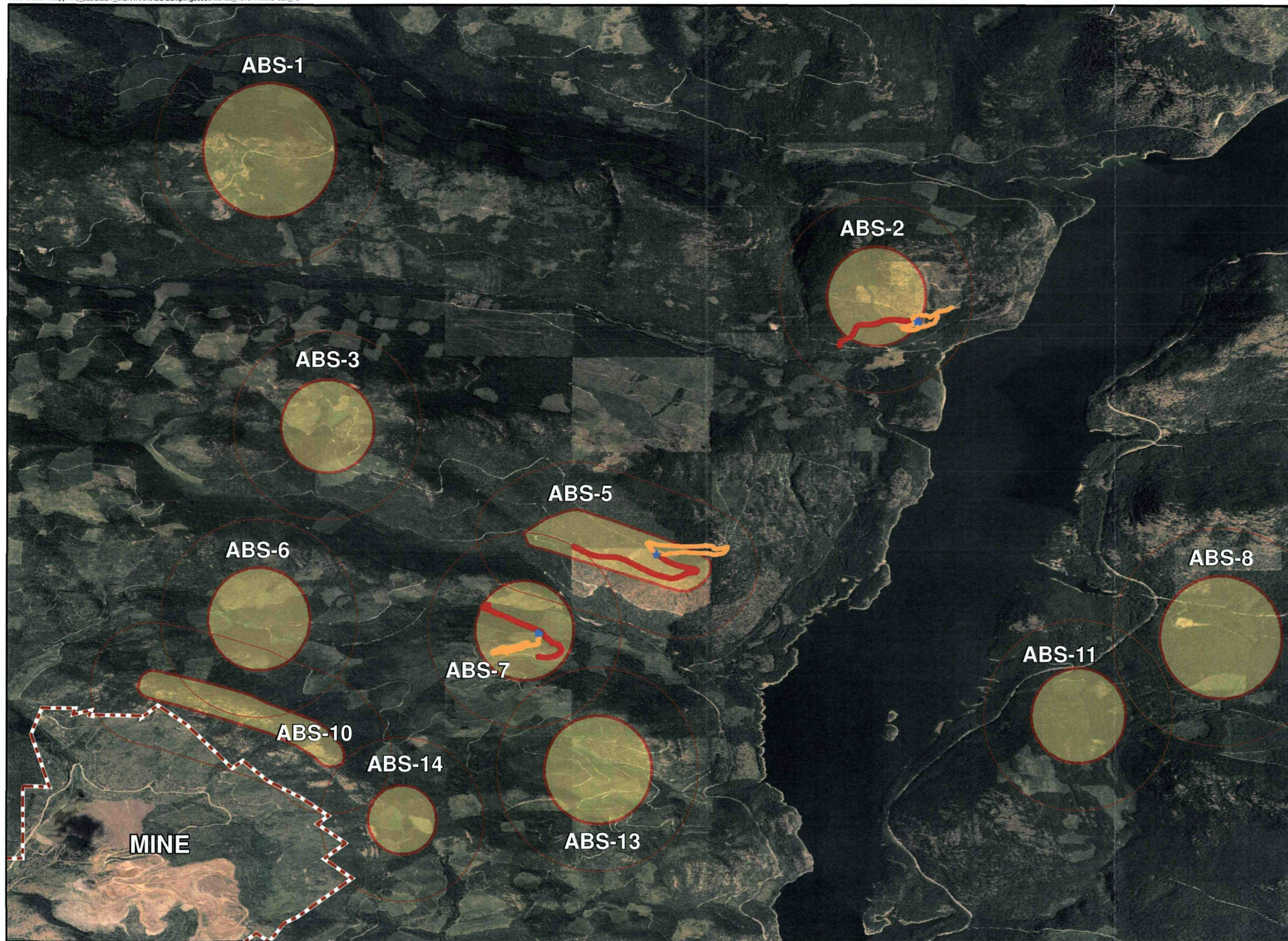
LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- WOOD GATHERING/ FIRE PIT
- HIKE
- ATV

ABS ROUND 7
October 5 - 9



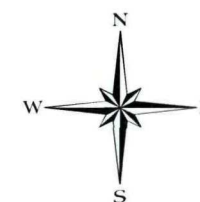
PROJECT: W. R Grace Libby, Montana	
FIGURE TITLE: ABS ROUND 7 GPS TRACKS	
MWH 10619 South Jordan Gateway Suite 100 Salt Lake City, Utah 84095	Date: 01/11/10 Rev:
	FIGURE NO: 2-8



LEGEND

- Mine Boundary
- ABS Location Zones with outer 0.5 mile Buffer Zone
- WOOD GATHERING/FIRE PIT
- HIKE
- ATV

ABS ROUND 8
November 9 - 11



0 1,500 3,000 6,000 Feet

PROJECT: W. R Grace
Libby, Montana

FIGURE TITLE:
ABS ROUND 8 GPS TRACKS

MWH
10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah 84095

Date: 01/11/10
Rev:
FIGURE NO:
2-9

TARGET SHEET
EPA REGION VIII
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 1135515

SITE NAME: LIBBY ASBESTOS

DOCUMENT DATE: 01/01/2010

DOCUMENT NOT SCANNED

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- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
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DOCUMENT DESCRIPTION:

1 CD - APPENDICES A, B, C, D (SEE TABLE OF CONTENTS)

